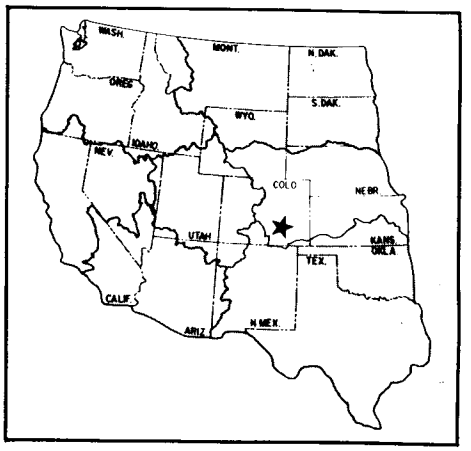
Fryingpan-Arkansas Project
(Under Construction)

Colorado: Eagle, Pitkin, Lake, Chaffee, Fremont, El Paso, Pueblo, Otero, Crowley, Bent, Prowers, and Kiowa Counties

Lower Missouri Region
Bureau of Reclamation



The Fryingpan-Arkansas Project is a multipurpose transmountain diversion development in southeastern Colorado. It will make possible an average annual diversion of 69,200 acre-feet of surplus water from the Fryingpan River and other tributaries of the Roaring Fork River on the western slope of the Rocky Mountains to the Arkansas River on the eastern slope.

Water diverted from the western slope, together with available water supplies in the Arkansas River Basin, will provide an average annual water supply of 163,100 acre-feet for supplemental irrigation of 280,600 acres in the Arkansas Valley. The project also will provide an annual supply of 40,988 acre-feet of water for use in several eastern slope municipalities (20,100 acre-feet to Colorado Springs, 8,040 acre-feet to Pueblo, and the remainder to other valley cities and towns which have requested project water to replace unsatisfactory supplies).

Ruedi Dam and Reservoir

The authorized plan for the project included two powerplants, with a total capacity of 211 megawatts. However, the potential power system is subject to modification and further study.

PLAN

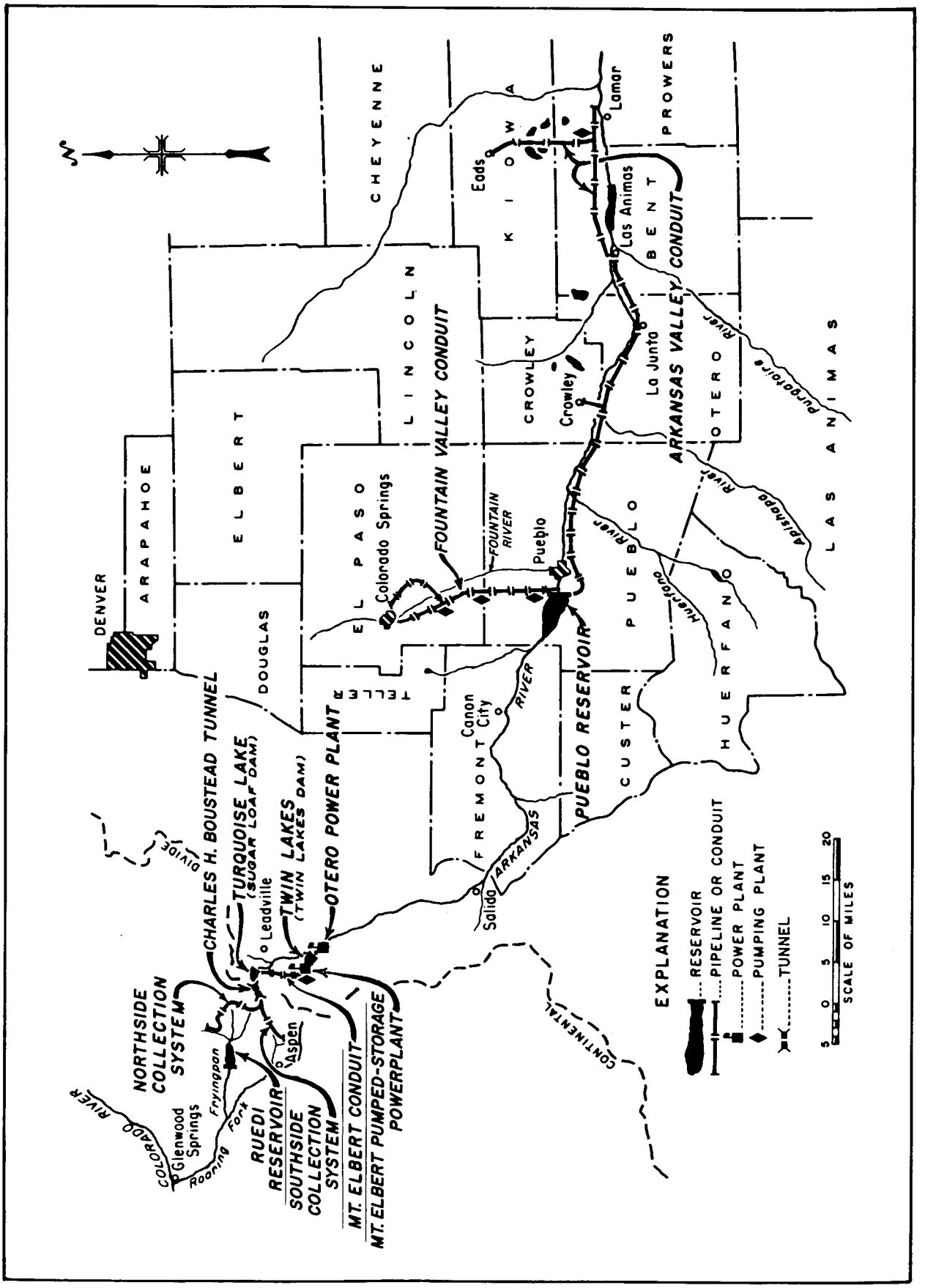
There are two distinct areas of the project: The western slope, located within the boundaries of the White River National Forest at elevations above 10,000 feet; and the eastern slope in the Arkansas River Valley. These areas are separated by the Continental Divide which, in many places, exceeds an elevation of 12,000 feet. The project plan consists of facilities designed primarily to divert water from the western slope to the water-short areas of the eastern slope.

There are six dams and reservoirs in the project: Ruedi Dam and Reservoir, on the western side of the mountain, is located on the Fryingpan River upstream from Basalt, Colo.; four dams and reservoirs on the eastern slope in the upper regions include Sugar Loaf Dam and Turquoise Lake, Mt. Elbert Forebay Dam and Reservoir, Twin Lakes Dam and Reservoir, and Clear Creek Dam and Reservoir. The largest of the Fryingpan-Arkansas Project storage units, Pueblo Dam and Reservoir, is on the Arkansas River west of Pueblo, Colo.

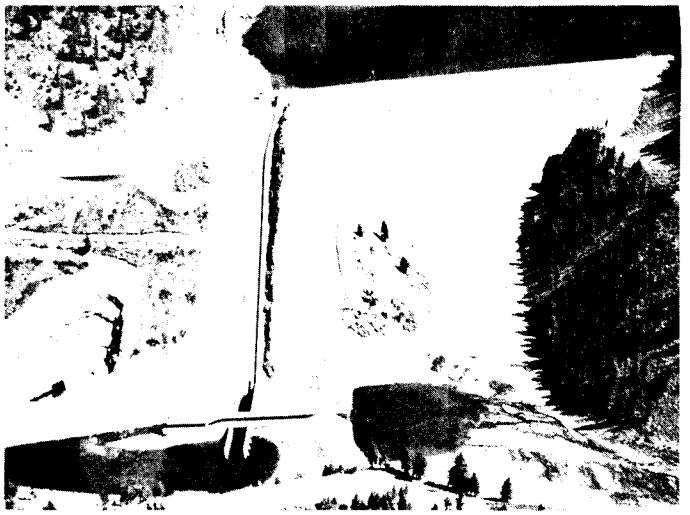
Sixteen diversion structures on the western slope are used to divert water into the Fryingpan-Arkansas Project collection system. The plan includes nine tunnels with a combined length of 26.7 miles.

The Western Slope

Ruedi Dam and Reservoir provide storage for replacement and regulation of approximately 100,000 acre-feet of water for the western slope users. This water will be used for irrigation and municipal benefits, and recreation and fish and wildlife enhancement.



Fryingpan-Arkansas Project



Ruedi Dam and Reservoir

The North and South Side Collection Systems on the western slope are being built to collect the melting snows and runoff from the high mountains. The diverted waters of the Fryingpan and Roaring Fork River Basins flow into the inlet portal of the Charles H. Boustead Tunnel. This tunnel conveys all the water from the North and South Collection Systems through the Continental Divide to Turquoise Lake.

The Eastern Slope

Turquoise Lake and Sugar Loaf Dam are located just east of the Continental Divide, approximately 5 miles west of Leadville, Colo. The lake provides storage capacity for the regulation of project water flowing from the Charles H. Boustead Tunnel.

Mt. Elbert Conduit, a 10.7-mile-long, 90-inch-diameter pipe, will convey water from Turquoise Lake to Mt. Elbert Forebay. The Halfmoon Diversion Dam will intercept the excess flows of Halfmoon Creek for diversion to Mt. Elbert Conduit. Water delivered to the forebay will be used for generation of power in the Mt. Elbert Pumped-Storage Powerplant. The powerplant is at the northwest corner of the lower lake of Twin Lakes. After going through the powerplant, the water will flow into Twin Lakes.

The plan provides for a new dam approximately 2,500 feet downstream from the present Twin Lakes. From Twin Lakes, the water will be conveyed through the Otero Canal to the Otero Powerplant at Clear Creek Reservoir. Power generated at the Mt. Elbert Pumped-Storage Powerplant and the Otero Powerplant will be delivered to existing power transmission systems in the area.

From Clear Creek Reservoir, the water will flow down the Arkansas River to Pueblo Dam where some of the project water will be diverted to the Fountain Valley and Arkansas Valley Conduits for delivery to municipal and industrial water users. The Pueblo Reservoir is the terminal storage feature for the project.

The Arkansas Valley Conduit transports water for municipal and industrial uses from Pueblo Reservoir to towns in the Arkansas Valley as far east as Lamar, Colo.

When completed, the project will provide an average annual diversion of 69,200 acre-feet of water from the western slope to the eastern slope.

Ruedi Dam and Reservoir

Ruedi Dam is on the Fryingpan River about 15 miles east of Basalt, Colo. The dam creates a reservoir with a total capacity of 102,369 acre-feet. Ruedi Dam is a rock and earthfill structure that stands about 285 feet high above streambed, has a crest length of 1,042 feet, and contains approximately 3,745,200 cubic yards of material.

The concrete spillway structure has an uncontrolled ogee-type crest, a chute section, a stilling basin, and a bridge over the spillway. The spillway has a capacity of 5,540 cubic feet per second. The outlet works, located under the right abutment of the dam, consists of a hexagonal intake structure with trashracks and a bulkhead gate, a 10-foot-diameter concrete-lined circular tunnel to a gate chamber housing a 5- by 6-foot high-pressure gate, an 11-foot-diameter concrete-lined horseshoe tunnel to a gate chamber housing a 5- by 6-foot high-pressure gate, an 11-foot-diameter concrete-lined horseshoe tunnel with a 76-inch-diameter steel pipe, a control house with two sets of 3.5- by 4-foot tandem gates and wye to a 76-inch-diameter steel pipe stub with a bulkhead just ahead of the control house. This bulkhead is to provide service to a future pipeline which will supply water to the potential Basalt Project. A shaft house and adit give access to the gate chamber of the outlet works and auxiliary works. The capacity of the outlet works is 1,810 cubic feet per second.

The auxiliary outlet works consists of an intake structure with trashracks, a 6-foot-diameter concrete-lined circular tunnel to a gate chamber housing a set of 2.5- by 3-foot tandem gates, and a concrete-lined 5- by 6-foot flat-bottom tunnel. The capacity is 600 cubic feet per second.

A concrete bypass, consisting of a concrete chute and stilling basin, bypasses flows of Rocky Fork Creek past the discharge of the spillway and auxiliary outlet.

Sugar Loaf Dam and Turquoise Lake

Sugar Loaf Dam and Turquoise Lake are east of the Continental Divide on the Lake Fork of the Arkansas River in Lake County, approximately 5 miles west of

Leadville. The reservoir storage capacity is 129,440 acre-feet. Sugar Loaf Dam is an earthfill structure, has a length of 2,020 feet, a height above riverbed of 135 feet, and contains approximately 1,833,700 cubic yards of material. In addition to the main earthfill section of the dam, there is a dike about 6,000 feet to the northeast. This dike is 475 feet long and 11 feet high. The spillway has a capacity of 2,920 cubic feet per second and consists of a morning-glory intake structure, a 16.5-foot-diameter monolithic concrete conduit, a chute and a stilling basin. The outlet works consists of an intake structure with trashracks, a 7-foot-diameter concrete conduit with a steel liner, a gate chamber housing a 5- by 6-foot high-pressure gate, an 11-foot-diameter concrete conduit with a steel liner, a 72-inch-diameter steel outlet pipe which bifurcates into two parallel branches just ahead of the control house for the river outlet, a river outlet control house with two 3.5-foot-square high-pressure gates for each branch, and a chute and stilling basin discharging to Lake Fork. A short 72-inch-diameter steel branch outlet pipe with a bulkhead was provided upstream from the bifurcation for future use, and as an outlet to the Mt. Elbert Conduit. The capacity of the river outlet is 1,120 cubic feet per second, and the capacity of the outlet to the Mt. Elbert Conduit is 370 cubic feet per second.

Pueblo Dam and Reservoir

Pueblo Dam is the terminal storage feature for the Fryingpan-Arkansas Project. The dam is located on the Arkansas River in Pueblo County about 6 miles upstream and west of the city of Pueblo. The reservoir has a total storage capacity of 357,678 acre-feet: 30,355 acre-feet of dead and inactive capacity; 234,347 acre-feet of conservation capacity; 65,952 acre-feet of joint-use capacity; and 27,024 acre-feet of exclusive flood-control capacity. The concrete dam and massive-head buttress-type spillway structure is the principal control structure for the reservoir. The concrete section is 1,750 feet wide with a maximum structural height of 250 feet. The spillway has a crest width of 550 feet and was designed for a maximum spill discharge of 191,500 cubic feet per second. The river outlet works is controlled by two 4-foot-square high-pressure gates and regulates normal water releases into the river. Additional releases may be made to the river through three separate spillway outlet works. Each is controlled by two 6- by 6.5-foot high-pressure gates. Delivery of water for municipal and industrial use is made from the south outlet works, which is a multilevel intake structure capable of taking water from the reservoir at different levels, thus providing a degree of control over water temperature and quality. Water deliveries from the fish hatchery outlet works have similar controls. Included in the outlet works are a stilling basin and outlet channel, a concrete river plug in the river channel, and the Bessemer Ditch headworks.

Sugar Loaf Dam and Turquoise Lake

Mt. Elbert Forebay Dam and Reservoir

Mt. Elbert Forebay occupies a saddle on a ridge above Twin Lakes Reservoir. The forebay will be impounded by a dam on the north side and a dike on the south rim. An outlet channel from the southeast corner of the reservoir will connect to the inlet-outlet structure for the powerplant penstock. The rolled earthfill forebay dam is about 2,600 feet long and 92 feet high. A 130-foot-long earth dike closes a low saddle at the southwest end of the reservoir. In 1980, the forebay was lined with a 45-mil reinforced chlorinated polyethylene flexible membrane lining material for seepage control. There is no spillway in the forebay dam. There is also no outlet works, other than the penstock inlet-outlet structure. Natural flow into the reservoir is negligible.

Twin Lakes Dam and Reservoir

Twin Lakes Dam and Reservoir will be located approximately 13 miles south of Leadville, in Lake County. The reservoir will have a total capacity of 141,000 acre-feet. The dam will be a zoned, rolled earthfill structure with a height above streambed of 53 feet. The crest of the dam will be 30 feet wide and 3,150 feet long. The spillway will be on the left abutment of the dam, and will have a capacity of 1,400 cubic feet per second. The spillway will be an uncontrolled concrete morning-glory inlet structure with a 9-foot-diameter concrete conduit under the dam embankment and a concrete stilling basin. A channel downstream from the stilling basin will carry the water to Lake Creek. The outlet works located in the right abutment will deliver 3,465 cubic feet per second to the river. The outlet works will have an inlet structure with trashracks, a 12-foot-diameter concrete conduit with steel liner, and a gate chamber housing a 9.0- by 12.0-foot high-pressure gate. A 16.75-foot-diameter horseshoe-shaped concrete conduit containing a 12.0-foot-diameter steel outlet pipe will lead from the gate

chamber to the river outlet control house where two 6.5-by 8.0-foot high-pressure gates will be located. A chute, stilling basin, and a 400-foot-long outlet channel will lead to Lake Creek. The Otero Canal will be served by a wye-junction structure appurtenant to the outlet works, upstream from the river outlet control house. This wye-junction structure will also serve Homestake's Otero intake pipeline to the Otero Pumping Station.

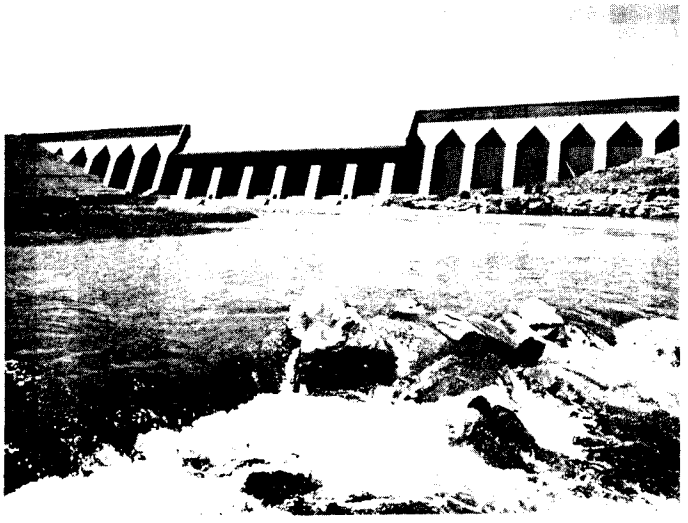
Clear Creek Dam and Reservoir

Clear Creek Dam and Reservoir will be located on Clear Creek a short distance from its confluence with the Arkansas River. The dam will be an earth and rockfill embankment with a crest length of 2,200 feet and will have a height of 75 feet above streambed. There is an earthfill dike with a crest length of 600 feet on the north side of the lake. The Pueblo Board of Water Works has storage rights of 11,440 acre-feet in Clear Creek Reservoir, and the reservoir will act as an afterbay for the Otero Powerplant. The spillway will be a combined concrete spillway and outlet works structure. It will have a gated inlet structure, a concrete chute passing under U.S. Highway 24, and a stilling basin and channel leading to the Arkansas River.

The Collection System

The North and South Side Collection Systems are located at approximately 10,000 feet elevation. The facilities are designed to divert and carry water from the Fryingpan and Roaring Fork River Basins to the inlet portal of the Charles H. Boustead Tunnel. This tunnel transports water from the collection system through the Continental Divide to the Arkansas River Basin.

The North Side Collection System is designed to divert, collect, and transport an average of 18,400 acre-feet of water annually through facilities of the Mormon, Carter, Ivanhoe, Granite, Lily Pad, North Cunningham, Middle Cunningham, and South Cunningham Creeks.



Pueblo Dam

The South Side Collection System is designed to transport an average of 50,800 acre-feet of project water annually from the Fryingpan and Roaring Fork River Basins. Facilities located on Hunter, Midway, and No Name Creeks will collect and divert water from Sawyer and Chapman Creeks, the South Fork of the Fryingpan River, and the main stem of the Fryingpan River downstream of Marten Creek.

North Side Collection System

Carter Tunnel: Carter Tunnel will be the first collection tunnel on the North Side Collection System. Water will be diverted into the tunnel by the Carter Diversion Dam through the 300-foot, 42-inch Carter Feeder Conduit to the inlet of the Carter Tunnel. The North Fork Diversion Dam will be a drop-inlet structure that will divert North Fork Creek water into the Carter Tunnel by the 280-foot-long North Fork Feeder Conduit. Carter Tunnel is 0.54 mile long and has an 8-foot horseshoe cross section with a capacity of 130 cubic feet per second. Water from Carter Tunnel will flow to the Mormon Conduit.

Mormon Tunnel: The Mormon Creek diversion structure will be connected to the intake portal of the Mormon Tunnel by the Mormon Feeder Conduit. The conduit will be a 250-foot-long structure, including a Parshall flume measuring device. The tunnel is 1.4 miles long, with an 8.25-foot horseshoe-shaped section having a capacity of 190 cubic feet per second. The water from Mormon Tunnel will flow to the Cunningham Tunnel.

Cunningham Tunnel: The North Cunningham, Middle Cunningham, and South Cunningham diversion structures will be connected to the Cunningham Conduit by feeder conduits which extend to the Cunningham Tunnel. The length of the three feeder conduits is 2,700 feet, and the Cunningham Conduit is 4,170 feet long. The Cunningham Tunnel is 2.86 miles long and has a horseshoe shape of two sizes: 8.75 and 7.5 feet. The capacity is 270 cubic feet per second. The Cunningham Tunnel flows into the Nast Tunnel.

Nast Tunnel: Ivanhoe Diversion Dam diverts water from Ivanhoe Creek and the Cunningham Tunnel through the Ivanhoe Creek crossing into the inlet of Nast Tunnel. The Granite Diversion Dam diverts water through the Granite Siphon to the Granite Adit, which drops the flow into the Nast Tunnel. The Lily Pad Diversion Dam drops the flow into Nast Tunnel. Nast Tunnel is 3 miles long, with a circular-shaped section with two diameters: 7.67 and 9.33 feet. The capacity of the tunnel is 360 cubic feet per second. The flow is conveyed to the Charles H. Boustead Tunnel by the Fryingpan Conduit, which is 2,481 feet long and 84 inches in diameter.

South Side Collection System

Hunter Tunnel: Hunter Tunnel will be 7.6 miles long. It will transport the flows diverted at No Name, Midway, and Hunter Creeks to Chapman Gulch at the Chapman Diversion Dam. The design capacity ranges from 90 cubic feet per second at No Name Creek, the point of the beginning of the South Side Collection System, to Midway Creek with 270 cubic feet per second at Chapman Gulch on the Chapman diversion site. No Name, Midway, and the Hunter Creeks diversion structures are all similar. Each has a sluicegate for bypassing all streamflow when water is not being diverted. When diversions are being made, minimum flow will be released through a bypass to maintain the stream. A side overflow section provides for passing floodflows. Flows will be diverted through a short flume section to a shaft which will drop the water into the Hunter Tunnel. Hunter Tunnel is a semihorseshoe-shaped structure with two sizes: 8.5 and 7.33 feet.

Chapman Tunnel: The Sawyer diversion drop inlet diverts water from Sawyer Lake into Sawyer Feeder Conduit (3,098 feet in length), and drops the water at Chapman Gulch. The water then flows to Chapman Diversion Dam, with the flow from Hunter Tunnel, to be diverted into Chapman Tunnel. Chapman Tunnel is a 2.8-mile-long, 7-foot horseshoe-shaped structure, with a capacity of 300 cubic feet per second.

South Fork Tunnel: The South Fork Diversion Dam diverts water from South Fork Creek to the South Fork Siphon, where it continues with the flow from the South Fork Creek and is conveyed by the South Fork Feeder Conduit to the inlet of the South Fork Tunnel. The South Fork Tunnel is a 3.1-mile-long, 8-foot horseshoe-shaped section, and has a capacity of 450 cubic feet per second. The tunnel discharges water into the Charles H. Boustead Tunnel. The Fryingpan Diversion Dam diverts water into the Fryingpan Siphon under the Fryingpan River to the inlet structure at Charles H. Boustead Tunnel.

Charles H. Boustead Tunnel: The Charles H. Boustead Tunnel conveys all the water collected at the Fryingpan diversion and in the North and South Side Collection Systems under the Continental Divide and into Turquoise Lake. The 10.5-foot-diameter, horseshoe-shaped tunnel is approximately 5.4 miles long. The capacity of the tunnel is 945 cubic feet per second. The Fryingpan Valley control structure at the inlet portal of the tunnel will regulate flows entering the Charles H. Boustead Tunnel. It is a concrete junction structure which contains two overflow weirs, one for each of the collection systems, a baffled apron wasteway drop structure to return the excess flows to the Fryingpan River, a connection and access hatchway structure to receive the flows from the Fryingpan Feeder Conduit, and a control structure housing a 10.5- by 12-foot radial gate. The entire structure is underground.

Mt. Elbert Conduit: Mt. Elbert Conduit will convey project water from Sugar Loaf Dam to the Mt. Elbert Forebay. Water delivered to the forebay will be used for the generation of power in the Mt. Elbert Pumped-Storage Powerplant. At Halfmoon Creek, additional water will be diverted to the conduit for delivery to the Mt. Elbert Forebay. A pipe turnout and conduit will deliver supplemental water from the conduit to the Leadville National Fish Hatchery. The conduit will be a 90-inch-diameter pipe, 10.7 miles long, and designed for a flow of 370 cubic feet per second from Sugar Loaf Dam to the forebay. It will consist of a series of siphon and free-flow conduit reaches. The Halfmoon Diversion Dam will intercept the excess flows of the Halfmoon Creek for diversion to Mt. Elbert Conduit. The diversion dam will consist of a concrete spillway overflow structure, earth wing dike structures, a gated concrete structure to bypass irrigation flows for downstream use, and a heading for a feeder conduit. The Halfmoon Feeder Conduit will be a 60-inch-diameter pipe, 3,202 feet long, and will deliver the flow diverted at Halfmoon Creek to the Mt. Elbert Conduit. Flow capacity of the feeder conduit will be 150 cubic feet per second.

Fountain Valley Conduit: The Fountain Valley Conduit will begin at Pueblo Dam, about 6 miles west of Pueblo, and end near Academy Boulevard, about 2 miles south of Colorado Springs. The conduit will convey approximately 20,100 acre-feet of project water annually to the communities of Stratmoore Hills, Widefield, Security, and Fountain. The Fountain Valley Conduit will be 45 miles long and will range from a 42- to 14-inch-diameter conduit. It will have five pumping plants, two regulating tanks, two surge tanks, and four terminal tanks. The capacity will be 31 cubic feet per second.

Otero Canal: Otero Canal will carry water from Twin Lakes to the Otero Powerplant and the Homestake Turnout near the powerplant intake structure. The canal will be 5.5 miles long; of this, 0.7 mile will be a bench flume, 0.2 mile a pipe siphon, 0.3 mile a tunnel, and the remaining 4.3 miles will be an open trapezoidal concrete-lined canal section. The canal will have a capacity of 725 cubic feet per second.

Power System

The Mt. Elbert Pumped-Storage Powerplant is on the north shore of picturesque Twin Lakes, approximately 13 miles southwest of Leadville, Colo., at the foot of 14,433-foot Mt. Elbert, Colorado's highest mountain peak. The powerplant was designed with modern architectural lines and is an all-concrete structure equivalent

Mt. Elbert Forebay Dam and Reservoir

to a 14-story building, although most of the structure is below ground.

Power is generated from water stored in the Mt. Elbert Forebay. The water drops through the penstocks an average of 445 feet, spinning each of two 138,000 horsepower hydroelectric turbine-generators and developing 200,000 kilowatts of electrical power.

To supplement the flow-through water received from Turquoise Lake through the Mt. Elbert Conduit, these generators have been designed to operate as a 170,000-horsepower electric motor which drives the turbines in reverse, and pumps the same water back up to refill the forebay. This pumping mode normally will be used during the very early morning hours, when power demands are low and surplus low-rate power is received from other generating stations. This pump-back storage principle is advantageous since the generating units can be started quickly and adjustments of power output can be made rapidly to respond to varying patterns of daily and seasonal power demands.

DEVELOPMENT

Early History

The eastern slope area of the project north of the Arkansas River was a part of the Louisiana Purchase in 1803. The remainder of the basin was claimed by Texas following the war with Mexico. Mexican claims to the territory were relinquished in 1845 when Texas entered the Union.

The project area was visited by various Spanish explorers during 1760-80. The first official exploration by the United States was made in 1806-07 by Lieutenant Zebulon Pike. Later explorations were directed by Captain John C. Fremont and Captain John W. Gunnison. The first permanent settlements were not established until after the discovery of gold in 1859-61. With the mining boom came immigrants who turned to agriculture to supply foodstuffs for the expanding population. Large cattle ranches appeared as the result of the cattle drives from Texas.

Investigations

Studies by the Bureau of Reclamation on a transmountain diversion project began in 1936. Intensive investigation started in 1941 resulted in a potential planning report in 1947 and 1948, followed by a special report in 1949 and official recommendations in 1951.

A revised planning report under the name Fryingpan-Arkansas Project in 1953 led to congressional approval of the project. In September 1959, a report that supplemented House Document No. 187, 83d Congress, 1st session, recommended Ruedi Dam and Reservoir instead of the previously recommended Aspen Dam and Reservoir.

Authorization

Construction of the Fryingpan-Arkansas Project was authorized by Public Law 87-590 (77 Stat. 393) signed by the President on August 16, 1962.

Construction

Construction began with Ruedi Dam and Reservoir in 1964, and numerous project features are completed or under construction. Initial project water for irrigation and municipal and industrial use was available in September 1975. Power was delivered from the first unit (100,000 kilowatts) in October 1981. An additional 100,000 kilowatts is scheduled to be available in 1984.

Initial project municipal and industrial water delivery to Colorado Springs and towns of the Fountain Valley is scheduled for 1982.

Operating Agencies

The Bureau of Reclamation operates and maintains the dams and reservoirs. The recreation and fish and wildlife facilities and resources at Ruedi Reservoir and Turquoise Lake are managed by the Forest Service. At Pueblo Dam and Reservoir, these facilities and resources are under the management of the Colorado Department of Natural Resources.

BENEFITS

Irrigation

Water diverted from the western slope and regulation of the Arkansas River flows will provide supplemental irrigation supplies for 280,600 irrigable areas in the Arkansas Valley. The project will enable farms to sustain and possibly increase the level of present agricultural productivity per acre. It will permit farmers to diversify the crops produced and be more responsive to market demands for food and fiber.

Because of the ability to diversify crops and meet peak demands, the value of total crop production of the Arkansas Valley will be increased. Major crops grown are alfalfa, corn, sorghum, and sugar beets. Specialty crops such as onions, beans, tomatoes, and melons are grown extensively in the valley.

Municipal and Industrial Water

Water for municipal and industrial use will be developed by the project to supplement existing supplies. Two separate water delivery pipeline systems, the Fountain Valley and Arkansas Valley Conduits, will begin at Pueblo Dam and convey water to organizations and communities on the eastern slope.

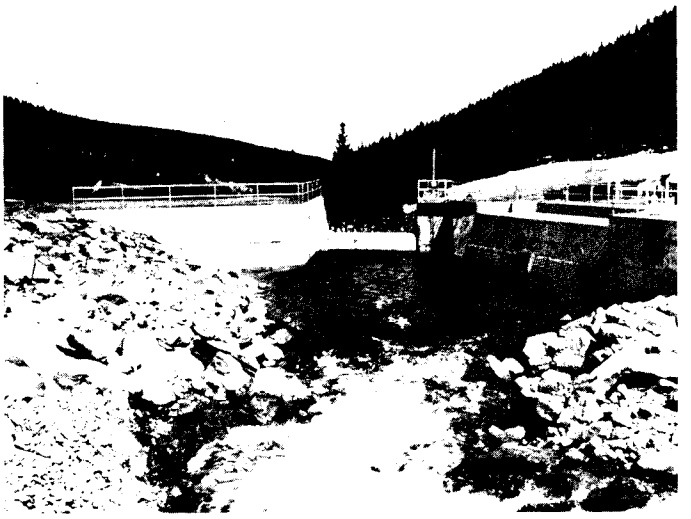
The cities of Colorado Springs and Aurora have contracted to use the conveyance system of the Fryingpan-Arkansas Project from Turquoise Lake to Clear Creek Reservoir for transportation of municipal water supplies owned by the two cities. Homestake Project water will be pumped by that entity from Clear Creek Reservoir into the Upper South Platte River Basin for delivery to the city water systems.

Recreation and Fish and Wildlife

Recreation facilities are being developed throughout the Fryingpan-Arkansas Project by the Bureau of Reclamation in cooperation with the National Park Service, Forest Service, and State and local agencies.

Ruedi Reservoir and the North and South Side Collection Systems are on the western slope, where snow-capped mountain peaks reach over 13,000 feet in elevation and thickly forested slopes provide an exceptionally beautiful background for swimming, boating, water skiing, fishing, picnicking, camping, and general relaxation. The Forest Service is developing and managing these recreation facilities.

Dominant game fish found in the rivers on the western slope include rainbow, brown, cutthroat, and brook trout. Development of Ruedi Dam and Reservoir has increased the available fish habitat in the area. Operation of the dam has exposed about six acres of gravel which now serve as a brown trout spawning ground immediately downstream from the dam. The gravel areas and regulated streamflow have improved the fishery through increased natural reproduction, and increased recreation opportunities in the immediate area. The most common big game species are deer and elk; black bears are seen occasionally.



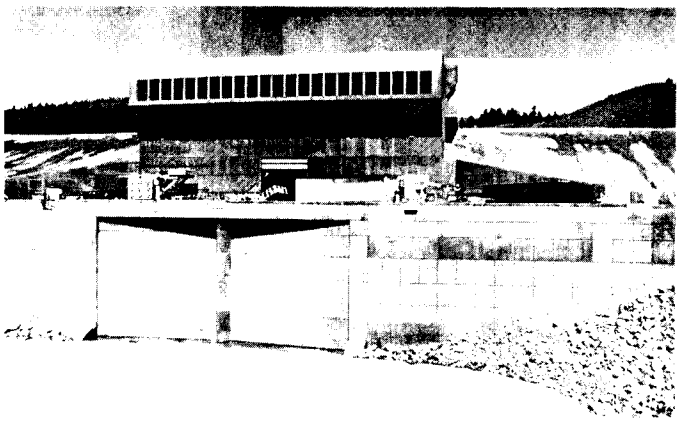
Chapman Diversion, South Side Collection System

Recreation activities at Turquoise Lake include sightseeing, camping, swimming, water skiing, boating, and hunting. Development of the lake has increased the aquatic habitat and surface acreage available for fish. Species in this area include kokanee salmon, and rainbow, brown, and lake trout. Recreation facilities are administered by the Forest Service.

Since the completion of Ruedi Dam and Reservoir, the Turquoise Lake enlargement in 1969, and Pueblo Dam and Reservoir in 1975, 2,051,947 visitor days of recreation have been recorded.

Existing recreation development in the area of Twin Lakes and the Mt. Elbert Forebay and Powerplant complex is water-oriented, with fishing and boating the major

South Fork Diversion, South Side Collection System



Mt. Elbert Pumped-Storage Powerplant

activities. Facilities consist of a boat ramp, boat and trailer parking lot, and two parking lots with minimum sanitary facilities. Construction of the Mt. Elbert Conduit will permit delivery of up to 3,000 gallons per minute of high quality water to the Leadville National Fish Hatchery. Dominant big game species are deer and elk, which migrate into the Twin Lakes area each winter and scatter throughout the area during the summer. Elk range north of the lakes in winter. Big and small game hunting in season is allowed in the areas adjacent to Twin Lakes.

Major recreation development planned for Pueblo Reservoir will provide water-oriented recreation in the Arkansas Valley. Facilities are being constructed by the Bureau of Reclamation and managed by the Colorado Department of Natural Resources. North and South Shore boat ramp, marina, parking, and harbor excavations have been completed.

A combination warm water fish hatchery and cold water rearing unit, to be managed and administered by the State of Colorado's Department of Natural Resources, will be constructed downstream from Pueblo Dam. This hatchery will provide most of the fingerlings for stocking Pueblo Reservoir and other reservoirs, streams and lakes within the project.

PROJECT DATA

Land Areas (1980)

Irrigable area:		
Supplemental irrigation service	280,600	acres
Number of irrigated farms	1,529	

Facilities in Operation[1]

Storage dams	6	
Diversion dams and structures	17	
Canals	4.3	mi
Conduit (includes siphons)	281.6	mi
Powerplants	2	
Transmissions lines	11.6	mi
Switchyards	2	
Substations[1]	2	
Tunnels	26.7	mi

[1]The facilities data include all project features, either completed, under construction, or proposed.

Climatic Conditions

Annual precipitation	11.6	in
Temperature:		
Maximum	114	°F
Minimum	59	°F
Mean	37-54	°F
Growing season	83-173	days
Elevation of irrigable area	3620-8350.0	ft

Settlement

Number of persons served with project water:	
Rural	64,700
Cities	272,700
Other water service	27,600
Total	365,000

ENGINEERING DATA

Water Supply

ARKANSAS RIVER

Drainage area near Pueblo Dam	4,686	mi²
Annual discharge:		
Maximum	980,100	acre-ft
Minimum	224,600	acre-ft
Average	519,000	acre-ft

(Does not include water diverted from the western slope.)

FRYINGPAN RIVER

Drainage area near Ruedi Dam	226	mi²
Annual discharge:		
Maximum	86,700	acre-ft
Minimum	341,200	acre-ft
Average	195,900	acre-ft

LAKE FORK CREEK

Drainage area near Sugar Loaf Dam	334	mi²
Average annual discharge	173,000	acre-ft

LAKE CREEK

Drainage area near Twin Lakes Dam	75	mi²
Average annual discharge	123,900	acre-ft

Storage Facilities

RUEDI DAM

Type: Earth and rockfill
Location: On the Fryingpan River about 15 mi east of Basalt, Colo.
Construction period: 1964-68
Reservoir, Ruedi:

Total capacity to El. 7766	102,369	acre-ft
Active capacity	101,280	acre-ft
Surface area	997	acres

Dimensions:		
Height above streambed	285	ft
Top width	30	ft
Maximum base width	1,453	ft
Crest length	1,042	ft
Crest elevation	7788.0	ft
Total volume (embankment)	3,745,200	yd³
Spillway: Uncontrolled concrete chute at the right abutment.		
Crest elevation	7766.0	ft
Capacity at El. 7781.8	5,540	ft³/s
Outlet works: A 10-ft-diameter concrete-lined tunnel through the right abutment, a gate chamber for a 5- by 6-ft high-pressure gate, and an 11-ft concrete-lined horseshoe tunnel with a 76-in-diameter steel pipe controlled by two sets of 3.5- by 4-ft tandem gates.		
Capacity at El. 7781.8	1,810	ft³/s
Auxiliary outlet works: A 6-ft-diameter concrete-lined tunnel, a chamber for two 2.5- by 3.0-ft tandem slide gates, and a concrete-lined 5- by 6-ft flat-bottomed tunnel.		
Capacity at El. 7766	600	ft³/s

Sugar Loaf Dam

Type: Earth and rockfill		
Location: On the Lake Fork of the Arkansas River, approximately 5 mi west of Leadville, Colo.		
Construction period: 1965-68		
Reservoir, Turquoise Lake:		
Total capacity to El. 9869.4	129,440	acre-ft
Active capacity	120,480	acre-ft
Surface area	1,788	acres
Dimensions:		
Height above streambed	135	ft
Top width	30	ft
Maximum base width	810	ft
Crest length	2,020	ft
Crest elevation	9879.0	ft
Total volume (embankment)	1,833,700	yd³
Spillway: Uncontrolled spillway entrance into concrete conduit.		
Crest elevation	9869.4	ft
Capacity at El. 9872.8	2,920	ft³/s
Outlet works: An 11-ft concrete conduit, controlled by a 1- by 6-ft high-pressure gate and four 3.5-ft-square high-pressure gates.		
Capacity at El. 9872.8	1,120	ft³/s

Pueblo Dam

Type: Earthfill dam with massive concrete buttresses with overflow section		
Location: On the Arkansas River 6 mi west of Pueblo, Colo.		
Construction period: 1970-75		
Reservoir, Pueblo:		
Total capacity to El. 4898.7	357,678	acre-ft
Active capacity	327,323	acre-ft
Surface area	5,664	acres
Dimensions:		
Height above streambed	191	ft
Top width	30	ft
Maximum base width	1,040	ft
Crest length	10,200	ft
Crest elevation	4925.0	ft
Total volume:		
Concrete	540,000	yd³
Embankment	12,000,000	yd³
Excavation	2,800,000	yd³
Spillway: An uncontrolled, overflow type spillway crest is provided with converging training wall and a concrete flip bucket.		
Crest length	550	ft
Crest elevation	4898.7	ft
Capacity at El. 4919	191,500	ft³/s
Outlet works: Has three 6- by 6.5-ft steel-lined concrete conduits located in the spillway buttresses 9, 11, and 13, with one 13.4- by 11.1-ft bulkhead gate and six 6.5-by 6.0-ft high-pressure slide gates. Also one 4-ft-square stainless steel-lined concrete conduit located in the river gorge area with a 9.8- by 7.4-ft bulkhead gate and two 4-ft-square high-pressure slide gates. Near buttress 8 are four mortar-lined steel conduits which converge to one conduit with only one sliding bulkhead gate, 5.3 by 6.4 ft, and a single level conduit intake located in buttress 7. There are three 4-ft-diameter conduits, and one 4-ft-diameter concrete conduit with one sliding bulkhead gate, 8.6 by 8.9 ft, and four 4-ft butterfly gates, plus a 9.5- by 8.4-ft concrete horseshoe-shaped conduit with four 3.5-ft-square high-pressure slide gates.		
Total capacity of the seven outlet works	5,767	ft³/s

Mt. Elbert Forebay Dam

Type: Earthfill		
Location: In Lake County approximately 12 mi southwest of Leadville, Colo.		
Construction period: 1977- (Under construction)		
Reservoir, Mt. Elbert Forebay:		
Total capacity to El. 9645.7	11,530	acre-ft
Active capacity	7,160	acre-ft
Surface area	279	acres
Dimensions:		
Structural height	92	ft
Top width	30	ft
Maximum base width	500	ft
Crest length	2,600	ft
Crest elevation	9652.0	ft
Total volume	3,101,207	yd³
Inlet-outlet works: A concrete inlet-outlet structure which separates into two 15-ft steel penstock pipes.		
Capacity at El. 9645.7	3,590	ft³/s

Twin Lakes Dam

Type: Earthfill		
Location: On Lake Creek approximately 13 mi south of Leadville, Colo.		
Construction period: 1978- (Under construction)		
Reservoir, Twin Lakes:		
Total capacity to El. 9200	141,000	acre-ft
Active capacity	68,000	acre-ft
Surface area	2,805	acres
Dimensions:		
Height above streambed	53	ft
Top width	30	ft
Maximum base width	300	ft
Crest length	3,150	ft
Crest elevation	9210.0	ft
Total volume:		
Embankment	624,000	yd³
Excavation	590,000	yd³
Spillway: Uncontrolled spillway entrance into a concrete conduit. (40-ft-diameter morning glory)		

Crest elevation	9200.0	ft
Capacity at El. 9202.3	1,400	ft³/s
Outlet works: A 12-ft-diameter steel-lined conduit with a gate chamber and 16.75-ft horseshoe conduit with a 12-ft-diameter steel outlet pipe to a bifurcation structure with one 9- by 12-ft outlet gate and two 6.5- by 8-ft high-pressure gates.		
Capacity at El. 9202.3	3,465	ft³/s

CLEAR CREEK DAM

Type: Earthfill		
Location: On Clear Creek about 14 mi northwest of Buena Vista, Colo.		
Construction period: Proposed		
Reservoir, Clear Creek:		
Total capacity to El. 8875	8,924	acre-ft
Active capacity	1,116	acre-ft
Surface area	382	acres
Dimensions:		
Height above streambed	75	ft
Top width	25	ft
Maximum base width	450	ft
Crest length	2,200	ft
Crest elevation	8885.0	ft
Total volume (embankment)	60,000	yd³
Spillway: Controlled spillway with four 8-ft high-pressure slide gates.		
Crest elevation	8859.0	ft
Capacity at El. 8881.2	5,865	ft³/s

Diversion Facilities

CHAPMAN DIVERSION DAM

Location: On the Chapman Gulch, to divert water into Chapman Tunnel.		
Construction period: 1965-71		
Dimensions:		
Height above streambed	13	ft
Weir crest length	20	ft
Weir crest elevation	10,038.23	ft
Spillway: Concrete gravity spillway with retaining walls in combination with an earth embankment.		
Capacity	810	ft³/s
Sluiceway: One 5- by 6-ft cast iron slide-gate with pedestal lift, and one 5-ft-wide overflow section.		
Headworks: Four 4-ft-square cast iron slide gates with pedestal lifts.		
Capacity	300	ft³/s

SOUTH FORK DIVERSION DAM

Location: On the South Fork of the Fryingpan River, about 7.5 mi south of Norrie, Colo.		
Construction period: 1965-71		
Dimensions:		
Height above streambed	13	ft
Weir crest length	20	ft
Weir crest elevation	10,003.0	ft
Spillway: Concrete gravity with retaining walls in combination with earth embankment.		
Capacity	740	ft³/s
Sluiceway: A 5-ft-square cast iron slide-gate with a pedestal lift, and 5-ft-wide overflow section adjacent to gate structure.		
Headworks: Four 3.5-ft-square cast iron slide-gates with pedestal lifts.		
Capacity	215	ft³/s

FRYINGPAN DIVERSION DAM

Location: On the Fryingpan River, 9 mi south of Norrie, Colo.		
Construction period: 1965-71		
Dimensions:		
Height above streambed	14	ft
Weir crest length	25	ft
Weir crest elevation	9961.9	ft
Spillway: Concrete gravity with retaining walls in combination with earth embankment.		
Capacity	1,100	ft³/s
Sluiceway: One 5- by 6-ft cast iron slide gate with pedestal lift, with 5-ft overflow section adjacent to gate.		
Headworks: Four 5- by 4-ft cast iron slide gates with pedestal lifts.		
Capacity	400	ft³/s

IVANHOE DIVERSION DAM

Location: On the Ivanhoe Creek approximately 7 mi east of Norrie, Colo.		
Construction period: 1973-76		
Dimensions:		
Height above streambed	10	ft
Weir crest length	20	ft
Weir crest elevation	10,008.8	ft
Spillway: Concrete gravity, with a retaining wall in combination with a Parshall flume.		
Capacity	605	ft³/s
Sluiceway: One 3-ft-square cast iron slide gate with pedestal lifts.		
Headworks: Two 4-ft-square cast iron slide gates with pedestal lifts.		
Capacity	150	ft³/s

LILY PAD DIVERSION INLET

Location: 9.5 miles southeast of Norrie, Colo.; diverts water into the Nast Tunnel.		
Construction period: 1970-73		
Dimensions:		
Interceptor ditch length	230	ft
Crest elevation	10,207.0	ft
Spillway: Dike, formed by an interceptor ditch, to drop inlet		
Capacity	20	ft³/s
Sluiceway: A 2-ft-diameter cast iron slide gate covers a 2-ft-diameter precast concrete sluiceway pipe.		
Headworks: 5- by 2.5-ft steel slide gate with a pedestal lift.		
Capacity	20	ft³/s

HALFMOON DIVERSION DAM

Location: On Halfmoon Creek, 9 mi southwest of Leadville, Colo.		
Construction period: 1977- (Under construction)		
Dimensions:		
Height of structure	18	ft
Spillway overflow crest length	50	ft
Spillway overflow crest elevation	9715.5	ft

Sluiceway: One 5- by 3-ft cast iron slide gate with pedestal lift.
Headworks: One 5-ft-square cast iron slide gate with pedestal lift.
Capacity ..... 150 ft³/s
Spillway: Concrete gravity
Capacity ..... 510 ft³/s

NORTH CUNNINGHAM DIVERSION STRUCTURE

Location: On Cunningham Creek about 6 mi east of Norrie Colo.
Construction period: 1976- (Under construction)
Dimensions:
Height of structure ..... 12 ft
Inlet size ..... 6 by 10 ft
Inlet elevation ..... 10,084.36 ft
Sluiceway: One 1-ft-square cast iron slide gate with flush bottom opening, motor-operated lift stem.
Headworks: One 2.5-ft-square cast iron slide gate, motor-operated lift and stem.
Capacity ..... 30 ft³/s
Spillway: An embankment dike, which flows into concrete drop inlet.
Capacity ..... 30 ft³/s

CARTER CREEK DIVERSION STRUCTURE

Location: On Carter Creek, 7 mi east of Norrie, Colo.
Construction period: 1976- (Under construction)
Dimensions:
Height above streambed ..... 8 ft
Weir crest length ..... 25 ft
Total crest length ..... 50 ft
Weir crest elevation ..... 10,130.25 ft
Spillway: Gated structure leading to an overflow weir.
Capacity ..... 100 ft³/s
Sluiceway: 7- by 8.5-ft cast iron radial gate, a 24-in-diameter concrete pipe bypass, and a 2-ft-square cast iron slide gate.
Headworks: A 5-ft-square cast iron slide gate with pedestal and stem hoist.
Capacity ..... 100 ft³/s

SAWYER DIVERSION STRUCTURE

Location: On Sawyer Creek, 4.5 miles south of Norrie, Colo.
Construction period: 1970-73
Dimensions:
Height above streambed ..... 6 ft
Weir crest length ..... 20 ft
Total crest length ..... 50 ft
Weir crest elevation ..... 10,084.5 ft
Spillway: Dike embankment with a concrete inlet.
Capacity ..... 30 ft³/s
Sluiceway: One 5-ft-diameter cast iron slide gate with a nonprojecting lift.
Headworks: One 2.5-ft-diameter cast iron slide gate with a nonprojecting lift.
Capacity ..... 30 ft³/s

MIDWAY CREEK DIVERSION STRUCTURE

Location: On Midway Creek, 7 mi east of Aspen, Colo.
Construction period: 1976- (Under construction)
Dimensions:
Height above streambed ..... 12 ft
Inlet size ..... 10 ft
Overflow weir length ..... 20 ft
Diversion elevation ..... 10,186.7 ft
Overflow weir length ..... 50 ft
Weir crest elevation ..... 10,190.2 ft
Spillway: A gated structure with an 8-ft diversion channel leading to an 8-ft-diameter vertical shaft.
Capacity ..... 85 ft³/s
Sluiceway: One 10- by 12-ft cast iron radial gate with a walled channel.
Headworks: One 5-ft-square cast iron slide gate with motor-operated lift and stem.
Capacity ..... 85 ft³/s

MIDDLE CUNNINGHAM DIVERSION STRUCTURE

Location: On Cunningham Creek, 5.5 mi east of Norrie, Colo.
Construction period: 1976- (Under construction)
Dimensions:
Height above streambed ..... 10 ft
Inlet length ..... 25 ft
Diversion length ..... 40 ft
Diversion elevation ..... 10,042.5 ft
Spillway: A gated structure with a 5-ft-square diversion channel leading to a vertical shaft.
Capacity ..... 50 ft³/s
Sluiceway: One 5- by 9-ft cast iron radial gate into a walled channel.
Headworks: 4-ft-square cast iron slide gate, with motor-operated lift and stem, to a 30-in feeder conduit.
Capacity ..... 50 ft³/s

MORMON CREEK DIVERSION STRUCTURE

Location: On Mormon Creek, 6.5 mi east of Norrie, Colo.
Construction period: 1976- (Under construction)
Dimensions:
Height above streambed ..... 10 ft
Inlet size ..... 5 by 5 ft
Overflow weir length ..... 15 ft
Diversion elevation ..... 10,092.0 ft
Weir length ..... 25 ft
Weir crest elevation ..... 10,094.65 ft
Spillway: A gated structure with a 5-ft-square diversion channel.
Capacity ..... 60 ft³/s
Sluiceway: One 5- by 10-ft cast iron radial gate.
Headworks: One 4-ft-square cast iron slide gate with a motor-operated lift and stem, to one 3-ft-diameter feeder conduit.
Capacity ..... 60 ft³/s

NO NAME CREEK DIVERSION STRUCTURE

Location: On No Name Creek, 5.5 mi east of Aspen, Colo.
Construction period: 1976- (Under construction)
Dimensions:
Height above streambed ..... 13 ft
Diversion elevation ..... 10,167.0 ft
Weir length ..... 26 ft
Weir crest elevation ..... 10,170.5 ft

Spillway: A gated structure with a 7- by 8-ft diversion channel to a vertical shaft.
Capacity ..... 95 ft³/s
Sluiceway: One 8- by 12-ft cast iron radial gate.
Headworks: One 5-ft-square cast iron slide gate with motorized stem and hoist.
Capacity ..... 95 ft³/s

HUNTER CREEK DIVERSION STRUCTURE

Location: On Hunter Creek, 7.5 mi east of Aspen, Colo.
Construction period: 1976- (Under construction)
Dimensions:
Height of shaft ..... 52 ft
Drop inlet size (diameter) ..... 12 ft
Top of inlet (elevation) ..... 10,175.5 ft
Weir crest length (headworks) ..... 30 ft
Weir crest elevation (headworks) ..... 10,179.0 ft
Weir crest length (sluiceway) ..... 60 ft
Weir crest elevation (sluiceway) ..... 10,182.5 ft
Spillway: A gated structure with a 5- by 8-ft diversion channel to a vertical shaft.
Sluiceway: One 8- by 10-ft cast iron radial gate.
Headworks: One 6-ft-square cast iron slide gate with motorized stem and hoist.
Capacity ..... 140 ft³/s

NORTH FORK DIVERSION STRUCTURE

Location: On the North Fork, 7 mi east of Norrie, Colo.
Construction period: 1976- (Under construction)
Dimensions:
Height above streambed ..... 13 ft
Weir crest length ..... 10 ft
Weir crest elevation ..... 10,211.9 ft
Spillway: A concrete inlet with a dike embankment.
Capacity ..... 30 ft³/s
Sluiceway: Overflow, one 2-ft-square cast iron slide gate with pedestal lift.
Headworks: One 2.5-ft-square cast iron slide gate and diversion channel to the intake of Carter Tunnel.
Capacity ..... 30 ft³/s

SOUTH CUNNINGHAM CREEK DIVERSION STRUCTURE

Location: On South Cunningham Creek, 5.5 mi east of Norrie, Colo.
Construction period: 1976- (Under construction)
Dimensions:
Height above streambed ..... 12 ft
Weir crest length ..... 8 ft
Inlet elevation ..... 10,534.0 ft
Spillway: A concrete inlet with dike embankment.
Capacity ..... 20 ft³/s
Sluiceway: Overflow, one 2-ft-square cast iron slide gate and with pedestal lift.
Headworks: One 2.5-ft-square cast iron slide gate with pedestal lift and stem.
Capacity ..... 20 ft³/s

GRANITE CREEK DIVERSION STRUCTURE

Location: 6.5 miles southeast of Norrie, Colo.; diverts water into the Granite Siphon.
Construction period: 1978-80
Dimensions:
Height above streambed ..... 4 ft
Weir crest length ..... 10 ft
Weir crest elevation ..... 10,078 ft
Spillway: An overflow from drop inlet with a crest length of 10 ft. Auxiliary spillway is a 15-ft-wide concrete weir overflow section.
Sluiceway: One 1.5-ft-square cast iron slide gate with motor-operated lift and stem.
Headworks: One 3-ft-square cast iron slide gate with motor-operated lift and stem.
Capacity ..... 50 ft³/s

Carriage Facilities

MORMON TUNNEL

Location: 7 mi east of Norrie, Colo.
Construction period: 1976- (Under construction)
Length ..... 1.4 mi
Capacity ..... 190 ft³/s
Cross section: Horseshoe
Diameter ..... 8 and 8.25 ft
Lining: Concrete and shotcrete

CUNNINGHAM TUNNEL

Location: 5.5 mi east of Norrie, Colo.
Construction period: 1974-76
Length ..... 2.9 mi
Capacity ..... 270 ft³/s
Cross section: Horseshoe
Diameter ..... 7.5 and 8.75 ft
Lining: Concrete and shotcrete

NAST TUNNEL

Location: 6 mi southeast of Norrie, Colo.
Construction period: 1970-74
Length ..... 3 mi
Capacity ..... 360 ft³/s
Cross section: Circular
Diameter ..... 7.67 and 9.33 ft
Lining: Concrete and shotcrete

CHAPMAN TUNNEL

Location: 5 mi south of Norrie, Colo., on Chapman Gulch.
Construction period: 1965-71
Length ..... 2.8 mi
Capacity ..... 300 ft³/s
Cross section: Horseshoe
Diameter ..... 7 ft
Lining: Concrete

SOUTH FORK TUNNEL

Location: 7 mi south of Norrie, Colo., on South Fork Creek.
Construction period: 1965-71
Length ..... 3.1 mi
Capacity ..... 450 ft³/s
Cross section: Horseshoe
Diameter ..... 8 ft
Lining: Concrete

CARTER TUNNEL

Location: 7 mi northeast of Norrie, Colo., on Carter Creek.
Construction period: 1976- (Under construction)

Length	0.54	mi
Capacity	100 and 130	ft³/s
Cross section: Horseshoe		
Diameter	8	ft
Lining: Concrete and shotcrete		

CHARLES H. BOUSTEAD TUNNEL

Location: About 5 mi southeast of Norrie, Colo., on the Fryingpan River.
Construction period: 1965-71

Length	5.4	mi
Capacity	945	ft³/s
Cross section: Horseshoe		
Diameter	10.5	ft
Lining: Concrete		

HUNTER TUNNEL

Location: 5 mi east of Aspen, Colo., on No Name Creek.
Construction period: 1970- (Under construction)

Length	7.6	mi
Capacity	90, 175, and 270	ft³/s
Cross section: Semihorseshoe, horseshoe		
Diameter	8.5 and 7.33	ft
Lining: Concrete and shotcrete		

GRANITE ADIT

Location: 3 mi southeast of Nast, Colo.
Construction period: 1970-74

Length	0.14	mi
Capacity	50	ft³/s
Cross section: Horseshoe		
Diameter	7.67 and 9.33	ft
Lining: Concrete and shotcrete		

GRANITE SIPHON

Location: 6.5 miles southeast of Norrie, Colo. between Granite Creek and Granite Adit.
Construction period: 1978-80

Length	0.76	mi
Capacity	50	ft³/s
Cross section: Circular		
Diameter	30 and 36	in

FRYINGPAN CONDUIT

Location: 9 mi southeast of Norrie, Colo., between Nast Tunnel and South Side Collection System.
Construction period: 1970-74

Length	2,481	ft
Capacity	360	ft³/s
Cross section: Circular		
Diameter	84	in

SAWYER CONDUIT

Location: 4 mi south of Norrie, Colo., between Sawyer Creek and Hunter Tunnel.
Construction period: 1970-73

Length	3,098	ft
Capacity	30	ft³/s
Cross section: Circular		
Diameter	27	in

CHAPMAN FEEDER CONDUIT

Location: 5 mi south of Norrie, Colo., between Chapman Diversion Dam and the Chapman Tunnel.
Construction period: 1970-73

Length	0.05	mi
Capacity	300	ft³/s
Cross section: Rectangular		
Size	8.33 by 11.00	ft
Type: Concrete		

MT. ELBERT CONDUIT

Location: 4 mi west of Leadville, Colo., in Lake County from Turquoise Lake to Mt. Elbert Forebay.
Construction period: 1977- (Under construction)

Length	10.7	mi
Capacity	370	ft³/s
Cross section: Circular		
Diameter	90	in

MORMON CONDUIT

Location: 7 mi east of Norrie, Colo., between the Carter Tunnel and Mormon Tunnel.
Construction period: 1976- (Under construction)

Length	0.33	mi
Capacity	130	ft³/s
Cross section: Circular		
Diameter	45	in

CUNNINGHAM CONDUIT

Location: 5.5 mi east of Norrie, Colo., between Mormon Tunnel and Cunningham Tunnel.
Construction period: 1976- (Under construction)

Length	4,170	ft
Capacity	220	ft³/s
Cross section: Circular		
Diameter	60	in

SOUTH FORK FEEDER CONDUIT

Location: 7 mi south of Norrie, Colo., between Chapman Tunnel and South Fork Tunnel.
Construction period: 1970-73

Length	0.07	mi
Capacity	215	ft³/s
Cross section: Rectangular		
Size	7.5 by 9.0	ft
Type: Concrete		

FRYINGPAN FEEDER CONDUIT

Location: 8.5 mi southeast of Norrie, Colo., between South Fork Tunnel and Charles H. Boustead Tunnel.
Construction period: 1970-73

Length	0.06	mi
Cross section: Rectangular		
Capacity	400	ft³/s
Size	9.25 by 13.0	ft
Type: Concrete		

IVANHOE FEEDER CONDUIT

Location: 6 mi east of Norrie, Colo., between Cunningham Tunnel and Nast Tunnel.
Construction period: 1975-76

Length	0.05	mi
Capacity	150	ft³/s
Cross section: Circular		
Diameter	84	in
Type: Concrete		

SOUTH CUNNINGHAM CONDUIT

Location: 5.5 miles east of Norrie, Colo., between Cunningham Tunnel and Nast Tunnel.
Construction period: 1976- (Under construction)

Length	0.4	mi
Capacity	20	ft³/s
Cross section: Circular		
Diameter	18, 21, and 24	in
Type: Precast concrete pressure pipe		

MT. ELBERT PUMPED-STORAGE POWERPLANT PENSTOCKS

Location: 13 mi southwest of Leadville, Colo., between Mt. Elbert Forebay and Mt. Elbert Powerplant on Twin Lakes Reservoir.
Construction period: 1972- (Under construction)

Length (each)	0.57	mi
Capacity (each)	3,400	ft³/s
Cross section: Circular		
Diameter (two)	15	ft
Type: Steel pipe		

FOUNTAIN VALLEY CONDUIT

Location: 6 mi west of Pueblo, Colo., to 2 mi. south of Colorado Springs, Colo.
Construction period: (Construction pending issuance of specifications)

Length	45	mi
Capacity	31	ft³/s
Diameter	42 to 14	in

OTERO CANAL

Location: From Twin Lakes to the Otero Powerplant and the Homestake Turnout.
Construction period: Proposed

Length[2]	5.5	mi
Capacity	725	ft³/s

[2]0.7 mi (bench flume), 0.2 mi (pipe siphon), 0.3 mi (tunnel), 4.3 mi (open trapezoidal concrete-lined canal).

Power Facilities

MT. ELBERT PUMPED-STORAGE POWERPLANT

Location: In Lake County, approximately 13 mi southwest of Leadville, Colo., on the north shore of Twin Lakes.
Construction period: 1972- (Under construction)

Nameplate capacity	200	MW
Number and capacity of generators	(2) 100	MW
Maximum head	477	ft

OTERO POWERPLANT

Location: In Chaffee County on Clear Creek Reservoir about 14 mi northwest of Buena Vista, Colo.
Construction period: Feasibility

Nameplate capacity	11	MW
Number and capacity of generators	(1) 11	MW
Maximum head	270	ft

SUBSTATIONS AND SWITCHYARDS

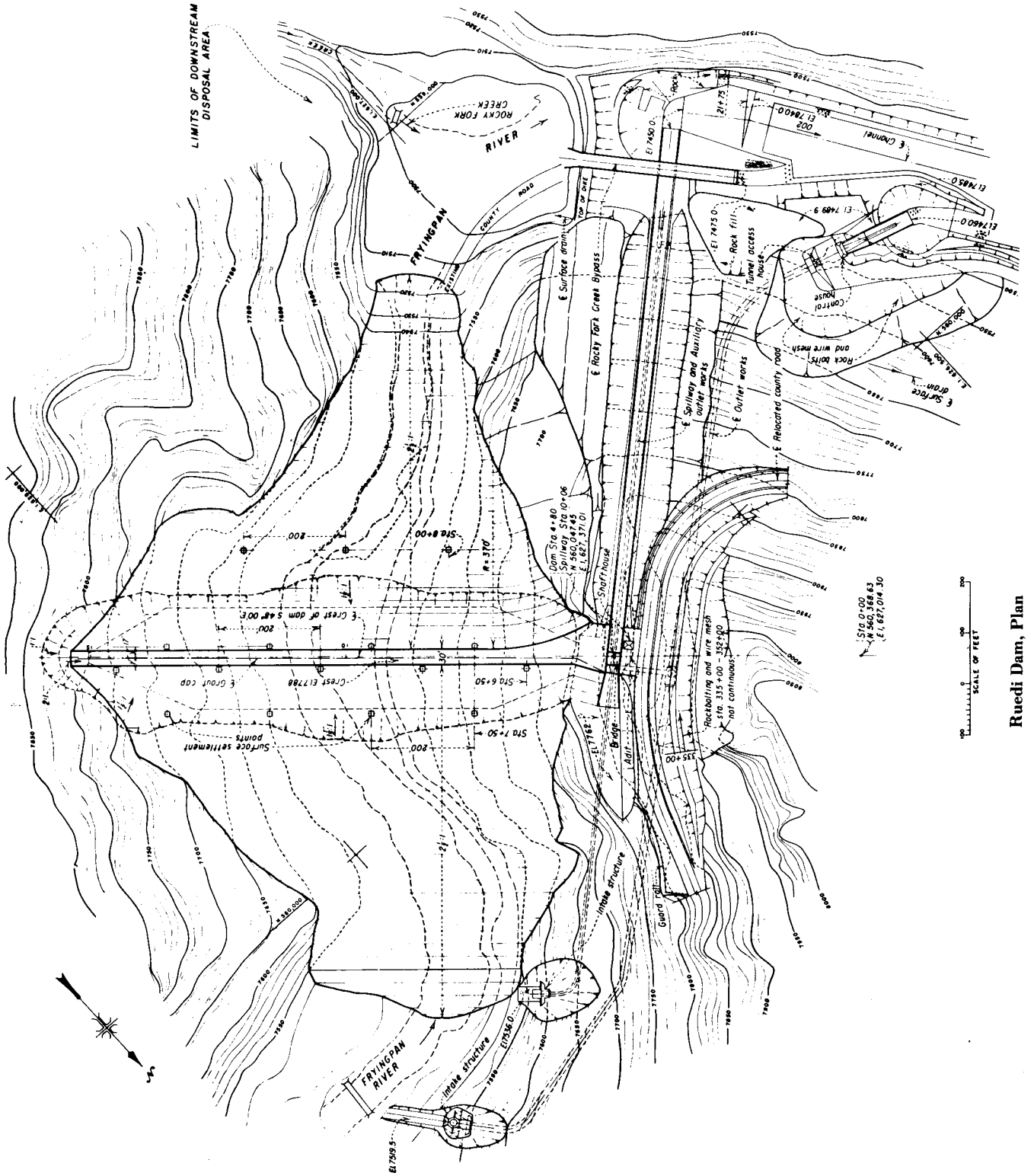
Substations	2	
Switchyards	2	
Total capacity of transformers	284,800	kVA

TRANSMISSION LINES

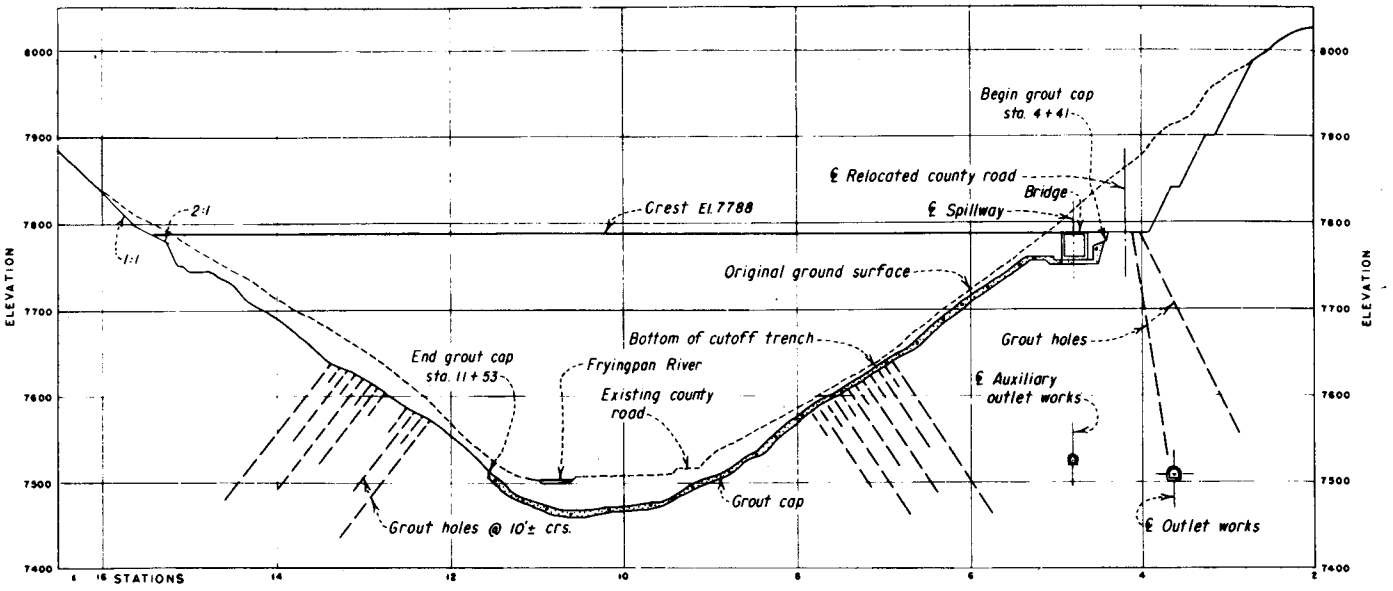
Total number of lines	3	
Total circuit miles	11.6	

DESIGNATION

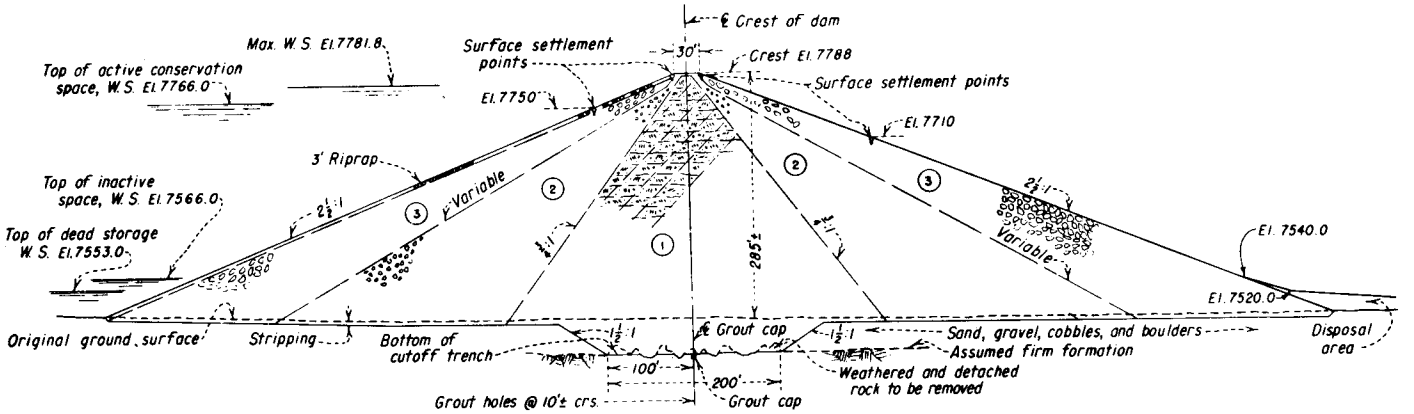
Mt. Elbert Pumped-Storage Powerplant to Mt. Elbert Switchyard:		
Voltage	230	kV
Power	447,120 kW at 0.9	P.F.
Circuit miles	1	
Mt. Elbert Switchyard to Malta Substation:		
Voltage	230	kV
Power	312,130 kW at 0.9	P.F.
Circuit miles	7.6	
Otero Switchyard to the Malta-Poncha 115 kV line:		
Voltage	115	kV
Circuit miles	3	



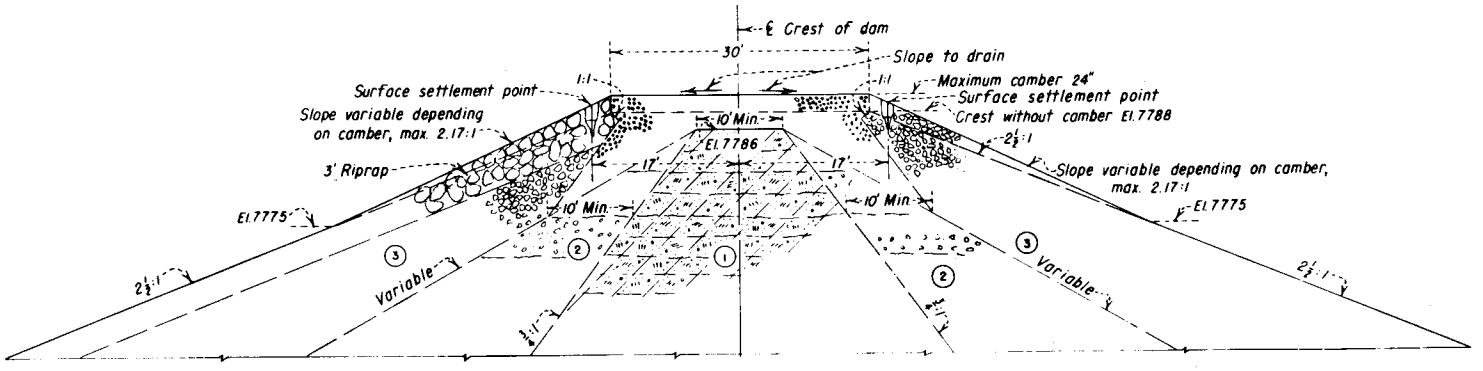
Ruedi Dam, Plan



PROFILE ON ℄ CREST OF DAM

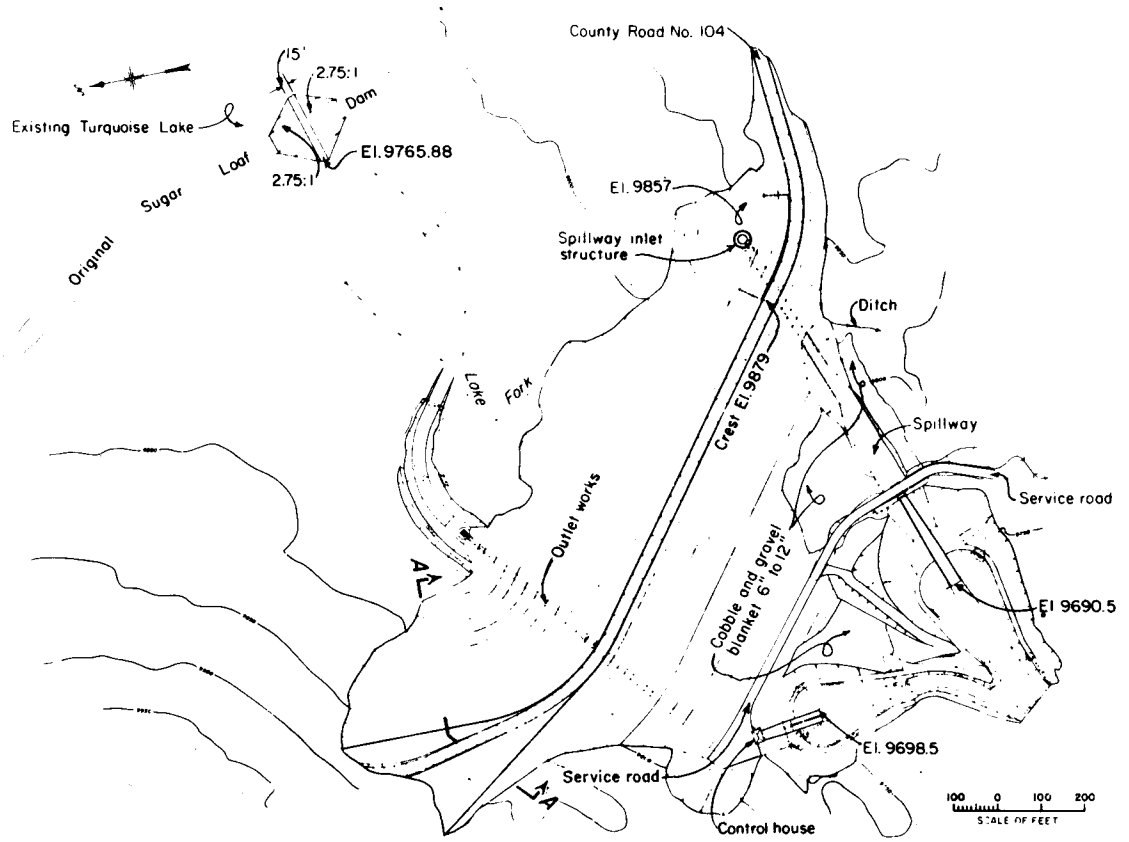


MAXIMUM SECTION

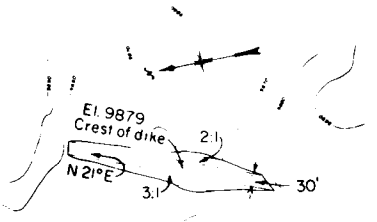


CREST DETAIL AT MAXIMUM CAMBER

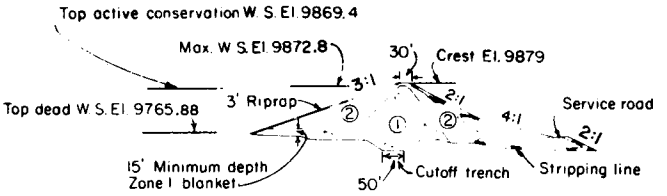
Ruedi Dam, Sections



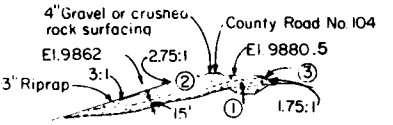
GENERAL PLAN – DAM



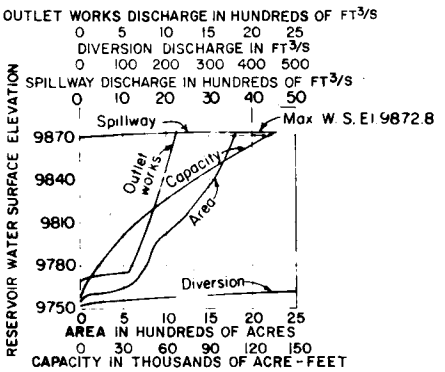
PLAN – DIKE



MAXIMUM SECTION – DAM



SECTION A-A



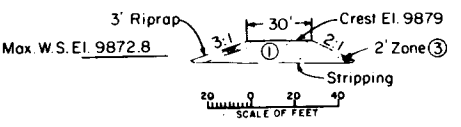
AREA – CAPACITY – DISCHARGE CURVES

EMBANKMENT EXPLANATION

(1) Silt, sand and gravel compacted to 6-inch layers by tamping roller.

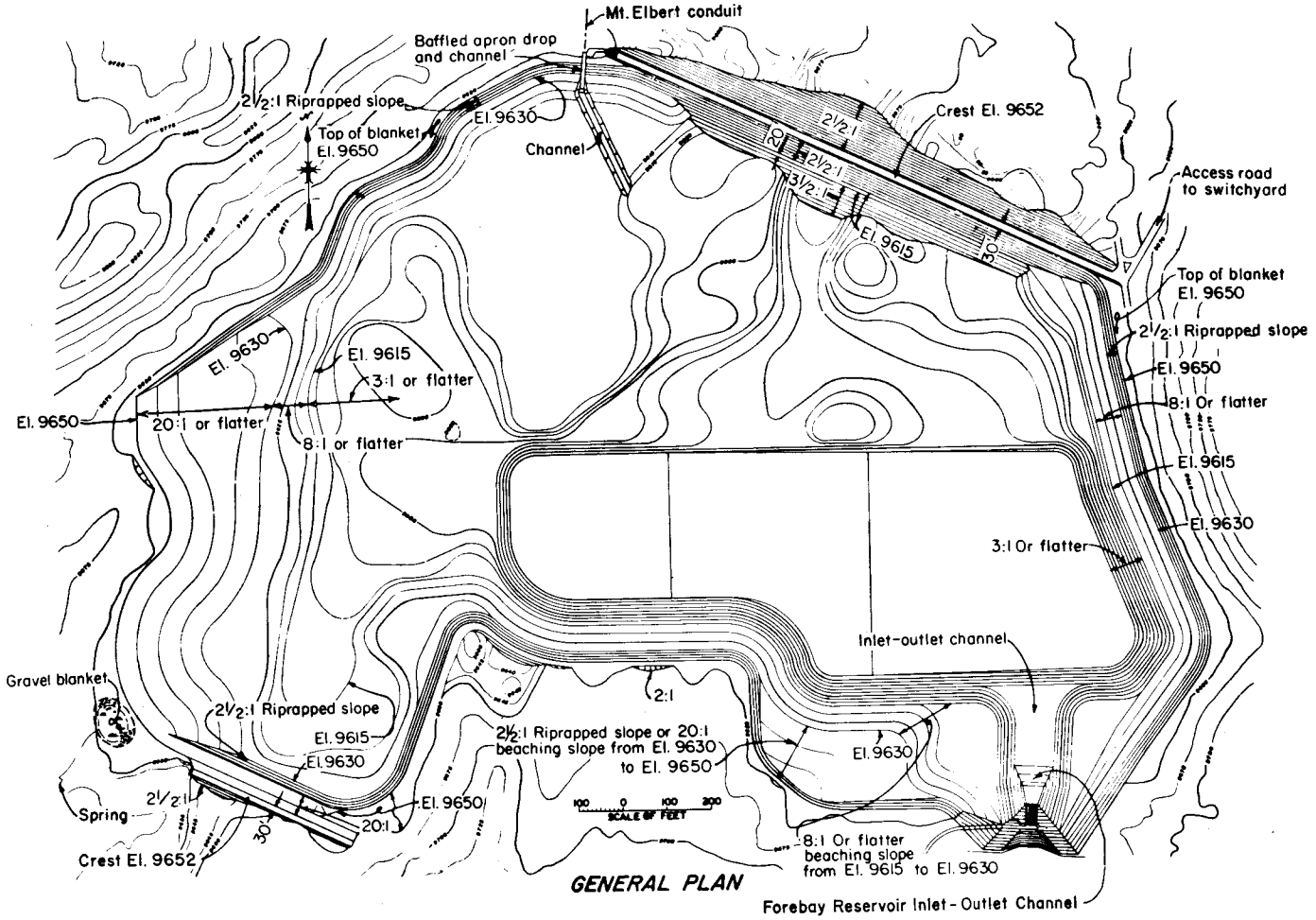
(2) Silty sand, gravel and cobbles compacted in 12-inch layers by crawler-type tractor.

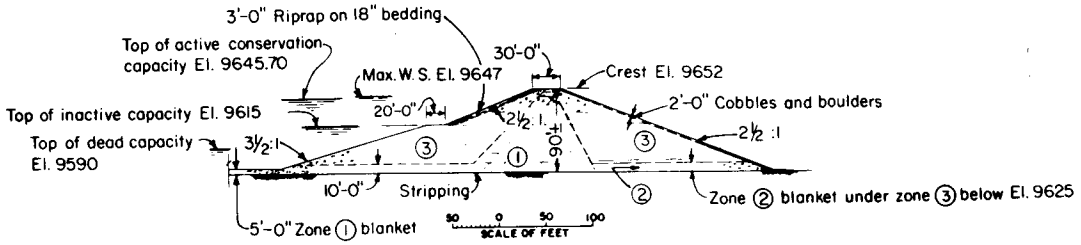
(3) Cobble and boulder fill placed in 3-foot layers.



MAXIMUM SECTION – DIKE

Sugar Loaf Dam, Plan and Sections





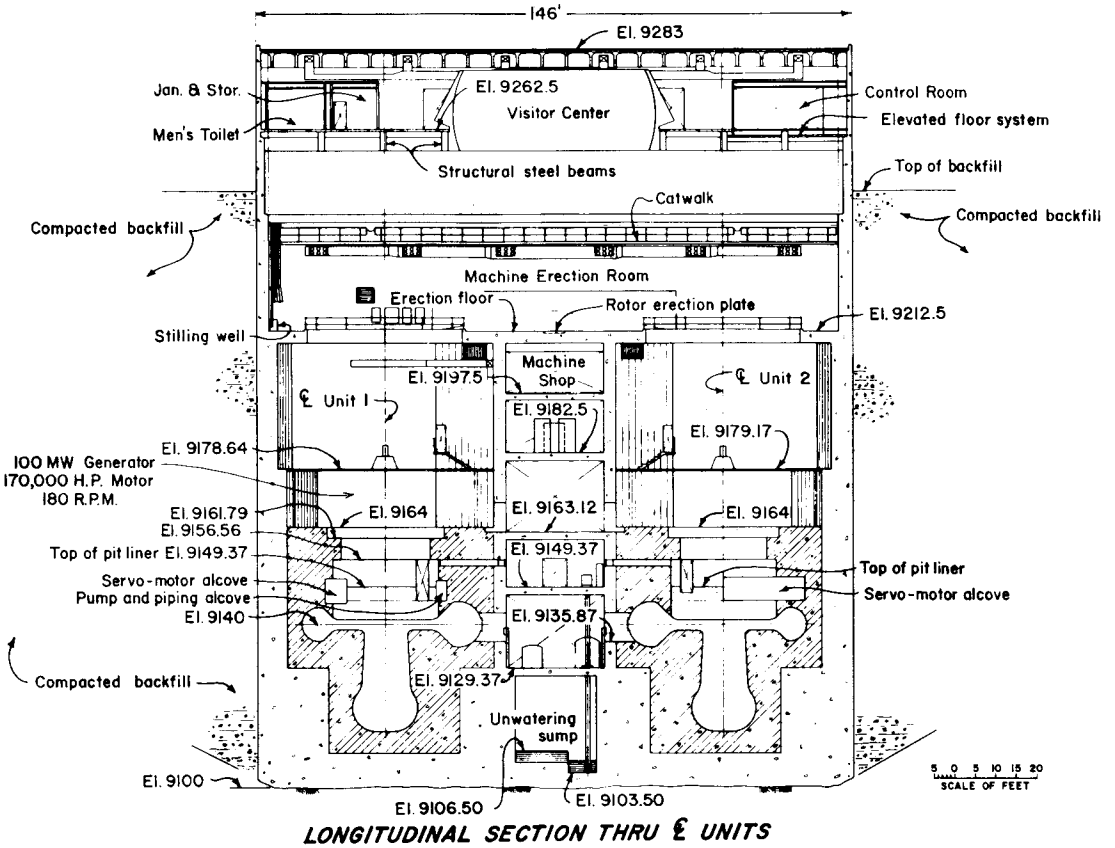
EMBANKMENT EXPLANATION

① Selected clay, silt, sand, and gravel compacted by tamping rollers to 6-inch layers.

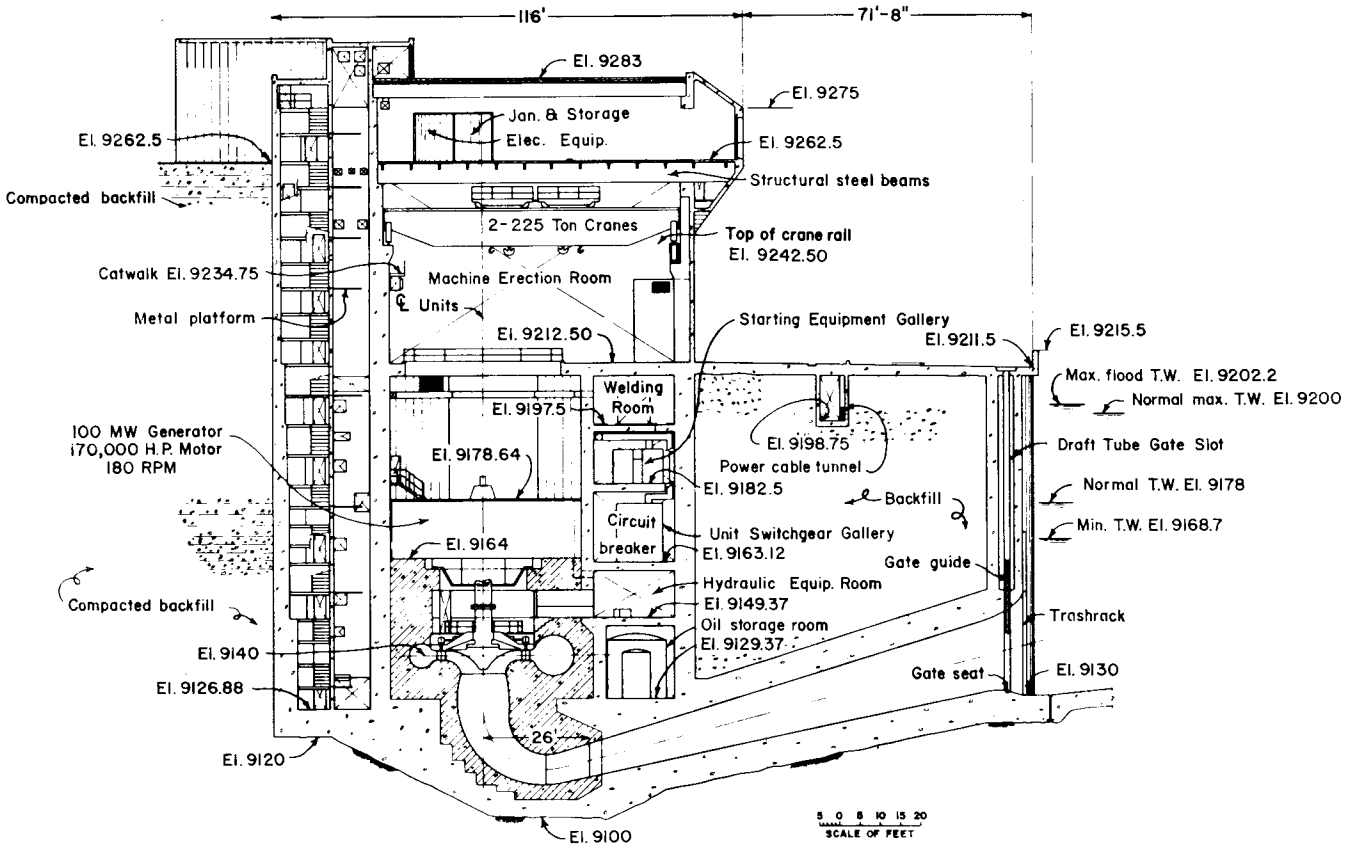
② Selected sand, gravel, and cobbles compacted by rubber-tired rollers to 12-inch layers.

③ Miscellaneous clay, silt, sand, gravel and cobbles compacted by rubber-tired rollers to 12-inch layers.

Mt. Elbert Forebay Dam, Plan and Section

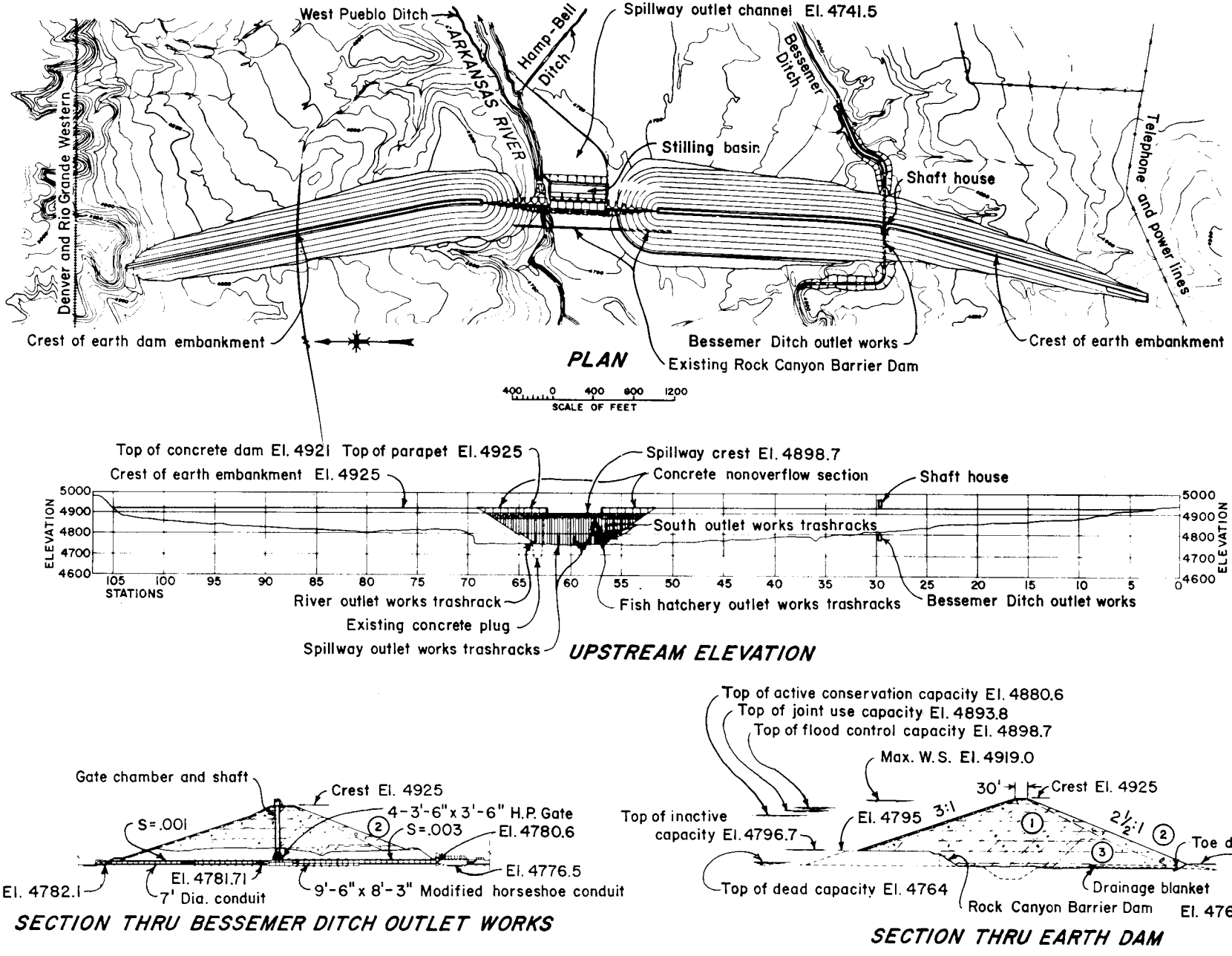


LONGITUDINAL SECTION THRU ℄ UNITS

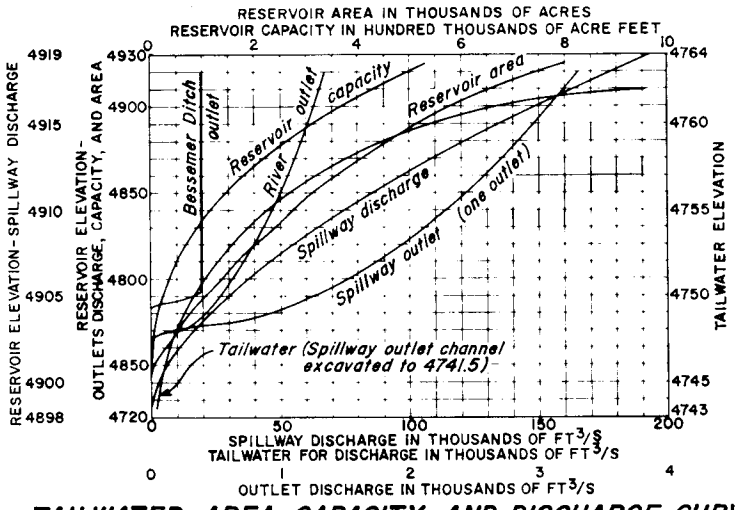


TRANSVERSE SECTION THRU ℄ UNIT 1

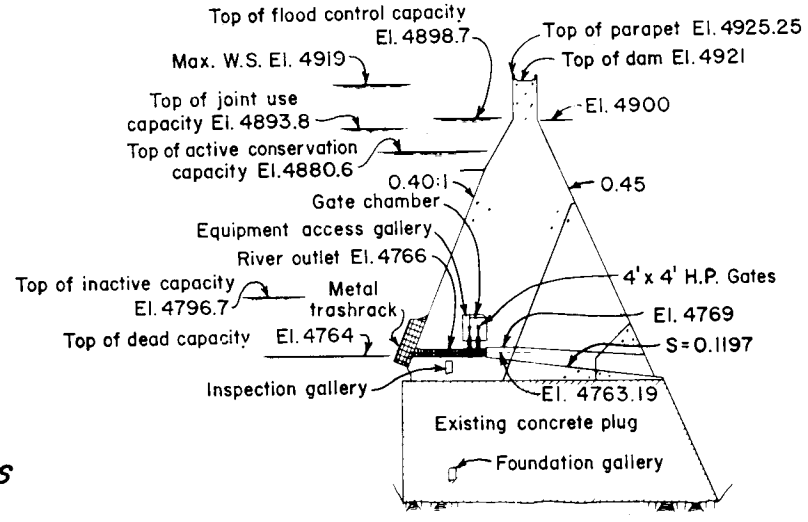
Mt. Elbert Pumped-Storage Powerplant, Sections



Pueblo Dam, Plan and Sections



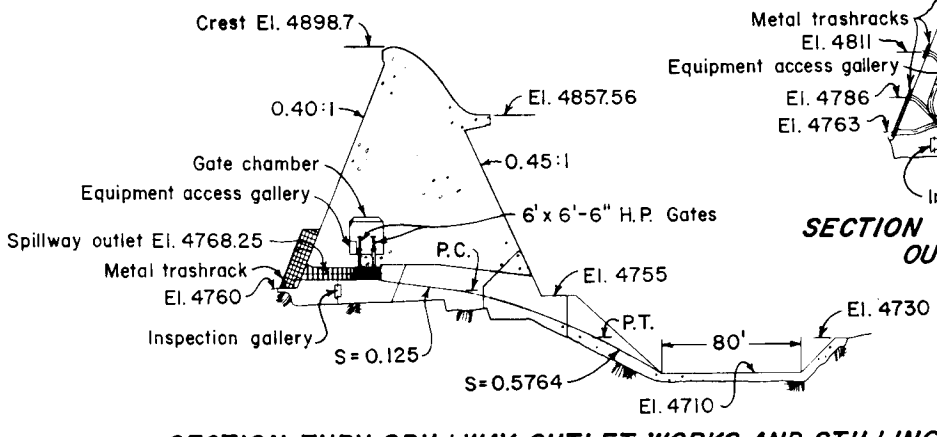
TAILWATER, AREA, CAPACITY, AND DISCHARGE CURVES



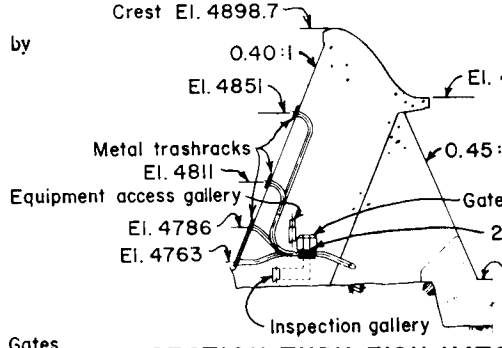
SECTION THRU RIVER OUTLET WORKS

EMBANKMENT EXPLANATION

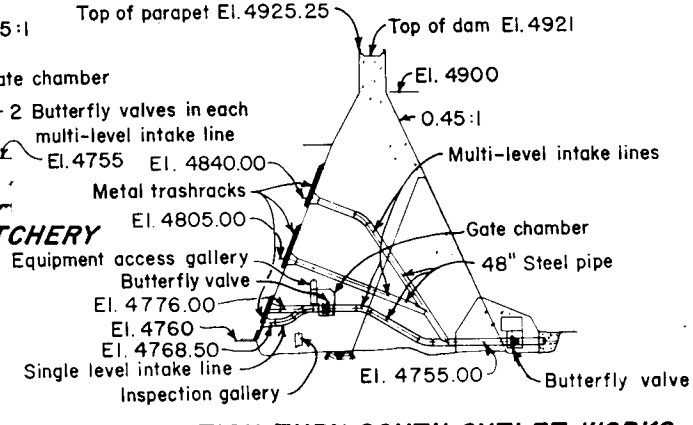
1. Clay, silt, sand, and gravel compacted by tamping rollers to 6-inch layers.
2. Sand, gravel, and cobbles compacted by crawler-type tractors to 12-inch layers.
3. Miscellaneous formation material compacted by tamping rollers to 6-inch layers.



SECTION THRU SPILLWAY OUTLET WORKS AND STILLING BASIN



SECTION THRU FISH HATCHERY OUTLET WORKS



SECTION THRU SOUTH OUTLET WORKS

Pueblo Dam, Sections